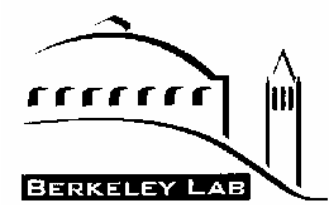

E.O. Lawrence Berkeley National Laboratory
University of California
Environmental Restoration Program

United States Department of Energy

ENVIRONMENTAL RESTORATION PROGRAM

QUARTERLY PROGRESS REPORT AND ANNUAL STATUS SUMMARY

FOURTH QUARTER FISCAL YEAR 2005
(July 1 to September 30, 2005)

for the
Lawrence Berkeley National Laboratory
Hazardous Waste Facility Permit

February 2006

QUARTERLY PROGRESS REPORT AND ANNUAL STATUS SUMMARY

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(July 1 to September 30, 2005)

for the Lawrence Berkeley National Laboratory
Hazardous Waste Facility Permit

A Joint Effort of
Environment, Health and Safety Division and
Earth Sciences Division
Lawrence Berkeley National Laboratory
Berkeley, CA 94720

February 2006

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Oakland, California 94612-5208

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ENVIRONMENTAL RESTORATION PROGRAM

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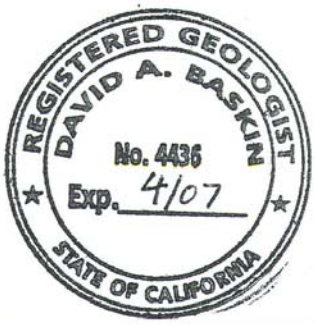

David A Baskin

Date: 27 February 2006

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Registered Geologist

Approved by:

Iraj Javandel

Date: 2/27/06

Iraj Javandel
Environmental Restoration Program

CONTENTS

LIST OF ABBREVIATIONS

AOC	Area of Concern
BAAQMD	Bay Area Air Quality Management District
BC	BC Laboratories
Cal-EPA	California Environmental Protection Agency
CAP	Corrective Action Program
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
DCA	Dichloroethane
DCE	Dichloroethene
DHS	California Department of Health Services
DOE	U.S. Department of Energy
DTSC	Cal-EPA Department of Toxic Substances Control
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
EH&S	Environment, Health and Safety Division
EML	LBNL Environmental Measurement Laboratory
ERP	Environmental Restoration Program
FY	Fiscal Year (October 1 to September 30)
GAC	Granular Activated Carbon
HRC	Hydrogen Release Compounds
HWHF	Hazardous Waste Handling Facility
ICMs	Interim Corrective Measures
ISCO	In Situ Chemical Oxidation
LBNL	Lawrence Berkeley National Laboratory
MCL	Maximum Contaminant Level
MCS	Media Cleanup Standard
mg/kg	milligrams per kilogram
MNA	Monitored Natural Attenuation
m/s	meters per second
µg/L	micrograms per liter (10^{-6} grams per liter)
NA	Not Analyzed
ND	Not Detected
NFA	No Further Action
NTLF	National Tritium Labeling Facility

PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene (Perchloroethene)
pCi/L	picocuries per liter (10^{-12} curies per liter)
QA	Quality Assurance
QAPP	Quality Assurance Program Plan
QC	Quality Control
RAML	LBNL Radiation Analytical Measurement Laboratory
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RPD	Relative Percent Difference
SOP	Standard Operating Procedure
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TCA	Trichloroethane
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
TPH-C/WO	Total Petroleum Hydrocarbons-Crude/Waste Oil
TPH-D	Total Petroleum Hydrocarbons-Diesel
TPH-G	Total Petroleum Hydrocarbons-Gasoline
TPH-H/MO	Total Petroleum Hydrocarbons-Hydraulic/Motor Oil
TPH-K	Total Petroleum Hydrocarbons – Kerosene
TOC	Total Organic Carbon
UC	University of California
USEPA	U. S. Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
Water Board	Regional Water Quality Control Board

EXECUTIVE SUMMARY

The Lawrence Berkeley National Laboratory (LBNL) Hazardous Waste Handling Facility operates under a Resource Conservation and Recovery Act (RCRA), Part B Hazardous Waste Facility Permit. The Permit requires LBNL to investigate and address all releases of hazardous waste at the facility and to issue quarterly progress reports that cover the following subjects:

- A description of work completed
- Summaries of all findings
- Summaries of all problems encountered and actions taken to rectify problems
- Projected work for the next reporting period.

This Quarterly Progress Report covers LBNL Environmental Restoration Program (ERP) activities conducted as part of the RCRA Corrective Action Program, during the fourth quarter of fiscal year 2005 (FY05) (July 1 through September 30, 2005).

GROUNDWATER MONITORING

Fourth quarter FY 2005 groundwater sampling started on July 5, 2005 and was completed on September 29, 2005. Groundwater monitoring data collected during the fourth quarter of FY05 (reporting period) are consistent with previous results. No volatile organic compounds (VOCs) or tritium was detected in the perimeter or offsite wells.

The number of groundwater samples submitted for each type of analysis during the reporting period is shown in the following table:

Number of Groundwater Samples Collected During the Fourth Quarter of FY 2005

	VOCs	TPH				PCBs	Metals	Tritium	Total
		-D	-G	-K	-FF				
Monitoring Wells Primary Samples	193	16	3	3	8	10	52	73	358
Duplicate Samples	4			1			3	3	11
Trip Blanks	5								5
Rinse Blanks	9	2					2	4	17
Slope Stability Wells	3							8	11
Temporary Sampling Points	68							13	81
Extraction Wells	76								76

VOCs: Volatile Organic Compounds
TPH-D: Total Petroleum Hydrocarbons in the diesel range
TPH-G: Total Petroleum Hydrocarbons in the gasoline range
TPH-K: Total Petroleum Hydrocarbons in the kerosene range
TPH-FF: Total Petroleum Hydrocarbons-fuel fingerprint
PCBs: Polychlorinated Biphenyls

The groundwater plumes and other areas of groundwater contamination where halogenated VOCs were detected at concentrations above MCLs during the current reporting period are listed in the following table, together with the maximum concentrations of halogenated VOCs that were detected above MCLs.

Maximum Concentrations (µg/L) of Halogenated VOCs Detected Above MCLs During the Fourth Quarter of FY05

Area	Groundwater Unit	1-1 DCA	1-2, DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	meth chloride	PCE	TCE	vinyl chloride	carbon tet
	MCL	**5**	**0.5**	**6**	**6**	**10**	**5**	**5**	**5**	**0.5**	**0.5**
Bevalac	Building 71B Lobe				56			249	42	16	
	Building 51/64 Plume	1750	7.6	603	267	48		393	201	22	
	Building 51L Plume	100		21	643	70		9.5	310	400	
	SB64-03-13	9									
	SB51A-01-8B				28			7.4	331		3.2
Old Town	Old Town Plume Building 7 Lobe	32		340	340	12	500	42,000	33,000	3.6	1,900
	Building 25A			19				39	161		1.5
	Building 52 Lobe							25	12		4.2
Support Services	Building 69A Area				44					52	
	Building 75A Area				43				7.4		
	Building 76 Area								15		

DCA: dichloroethane
DCE: dichloroethene
PCE: tetrachloroethene
TCE: trichloroethene
meth chloride: methylene chloride
carbon tet: carbon tetrachloride

The only aromatic hydrocarbon detected at a concentration above the MCL during the reporting period was benzene (70 µg/L maximum) in MW7-00-4, MW91-4, and MW75A-00-7. The benzene detected in these three deep Orinda Formation wells is believed to be naturally occurring.

Several former underground storage tank (UST) sites and other locations where petroleum hydrocarbons had previously been detected in the groundwater were sampled for total petroleum hydrocarbons (TPH) during the current reporting period. TPH in the diesel (TPH-D), kerosene (TPH-K), crude/waste oil (C/WO), and hydraulic/motor oil (H/MO) ranges was detected at maximum concentrations of 580 µg/L, 150 µg/L, 300 µg/L, and 51 µg/L respectively. Concentrations of TPH detected during the current reporting period are consistent with previous results.

Since closure of the National Tritium Labelling Facility (NTLF) in 2001, concentrations of tritium in groundwater have been declining in almost all wells monitoring the Building 75 Tritium Plume, indicating a reduction in the lateral extent of the plume. Tritium concentrations are currently below the MCL in all wells.

Annual site-wide sampling of groundwater monitoring wells for metals was conducted during the current reporting period. Detected metals concentrations were consistent with previous results. The only metals detected at concentrations above the MCL were arsenic in five wells, selenium in one well, and barium in one well. The elevated levels of metals detected may be naturally occurring.

Groundwater samples were collected at 17 locations during the current reporting period and analyzed for polychlorinated biphenyls (PCBs). PCBs (30 µg/L maximum) were only detected in samples collected beneath the Building 51 Motor Generator Room Basement. Detected PCB concentrations were consistent with previous analytical results

MEETINGS

Remedial Project Managers meetings were held at the Department of Toxic Substances Control (DTSC) offices on August 11 and September 8, 2005.

CORRECTIVE MEASURES

Following is a summary of the Interim Corrective Measures (ICMs) and pilot tests that were implemented during previous reporting periods and are continuing as the approved corrective measures for contaminated groundwater.

Old Town Groundwater Solvent Plume (Building 7 lobe)

- Continued operation of the in situ soil flushing system (Building 7 Groundwater Collection Trench) in the Building 7 lobe source area downgradient from the former Building 7 sump location.
- Continued operation of the in situ soil flushing system in the building 7 lobe core area downgradient from the Building 7 Groundwater Collection Trench.
- Continued operation of the following groundwater collection trenches to control plume migration.
  - Building 58 West Groundwater Collection Trench
  - Building 58 Southeast Groundwater Collection Trench.
- Continued operation of the dual-phase (groundwater and soil vapor) extraction wells on the Building 53/58 slope.

Old Town Groundwater Solvent Plume (Building 52 Lobe)

- Continued in situ soil flushing in the Building 52 lobe source area.
- Continued extraction and treatment of groundwater from the Building 46 subdrain.

Old Town Groundwater Solvent Plume (Building 25A Lobe)

- Continued in situ soil flushing in the Building 25A lobe source area.

Building 51/64 Groundwater Solvent Plume

- Continued in situ soil flushing in the source area.

Building 71B Lobe of the Building 71 Groundwater Solvent Plume Area

- Continued in situ soil flushing/HRC injection in the source area.

Building 51L Groundwater Solvent Plume

- Continued operation of the groundwater extraction and treatment system until the storm drain is reconstructed to prevent the inflow of contaminated groundwater to the storm drain system.

Contaminated Drain Lines

- Continued capture and treatment of contaminated Building 51 area hydrauger effluent.
- Continued extraction and treatment of groundwater from the Building 51 drainage system.
- Continued extraction and treatment of water from an electrical utility manhole (EMH-133) and drain 37-01-01 east of Building 6.

These measures have generally resulted in decreases in the concentrations of VOCs detected in groundwater. Significant decreases include:

- The concentrations of VOCs detected in most wells monitoring the source, core, and transgradient areas of the Building 7 lobe have declined since in situ soil flushing began in the source area in 1997. Significant declines in concentrations also occurred after the start of in situ soil flushing in the core area and after discharge of treated groundwater began on the Building 53/58 slope for soil flushing.

- The concentrations of VOCs detected in most wells monitoring the Building 52 lobe have declined since in situ soil flushing began in 2003, with concentrations of VOCs in wells in the source area declining to levels below MCLs.

- The concentrations of VOCs detected in wells monitoring the Building 25A lobe source area have declined since in situ soil flushing began in 2002. The concentrations of total VOCs detected in MW25A-98-3 and MW25A-98-1 have decreased from approximately 250 µg/L to about 50 µg/L. Concentrations in several downgradient wells have also been declining.

- Concentrations of VOCs detected in the Building 51/64 plume source area decreased significantly after the source area ICM excavation was completed, and have declined further since in situ soil flushing was started in 2003. Before implementation of the source area ICM, halogenated VOCs were detected in groundwater in the source area at total concentrations above 700,000 µg/L. The concentration of total halogenated VOCs currently detected in groundwater in the source area is approximately 2,000 µg/L or less.

- Concentrations of VOCs in wells in the source and upgradient core areas of the Building 71B lobe have declined significantly since HRC injection/soil flushing was started. These results indicate that HRC has been effective in expediting the degradation process.

In addition to the corrective measures noted above, the following activities continued during the reporting period:

Building 7 Diesel Plume - Building 7E Former Underground Storage Tank (UST) (AOC 2-1)

- Continued operation of the Building 6 dual-phase (groundwater and soil vapor) extraction system.

Contaminated Drain Lines

- Continued extraction and treatment of water from the concrete sump installed inside Building 51A and SB58-98-4.

SECTION 1

INTRODUCTION

1.1 PURPOSE AND SCOPE

The Lawrence Berkeley National Laboratory (LBNL) Hazardous Waste Handling Facility (HWHF) operates under a Resource Conservation and Recovery Act (RCRA), Part B Hazardous Waste Facility Permit issued by the California Environmental Protection Agency (CAL-EPA) Department of Toxic Substances Control (DTSC). The Permit was issued on May 4, 1993, and requires LBNL to investigate and address all releases of hazardous waste that may have occurred at the facility and issue quarterly progress reports. This Quarterly Progress Report documents RCRA Corrective Action Program (CAP) activities conducted by the LBNL Environmental Restoration Program (ERP) during the fourth quarter of fiscal year 2005 (FY05), which covers the period from July 1 through September 30, 2005. In accordance with permit requirements, the progress reports cover the following subjects:

a. A description of work completed (Executive Summary).
b. Summaries of all findings, including summaries of laboratory data (Section 4).
c. Summaries of all problems or potential problems encountered during the reporting period and actions taken to rectify problems (Section 5).
d. Projected work for the next reporting period (Section 7).

Historical trends in contaminant concentrations in groundwater are also discussed. In addition, the report for the fourth quarter of each fiscal year (i.e., the current report) provides tables of the historical groundwater data for volatile organic compounds (VOCs) and four quarters of groundwater data for other analytes.

1.2 STATUS OF RCRA CORRECTIVE ACTION PROGRAM

LBNL is currently beginning Corrective Measures Implementation (CMI), the final phase of the RCRA CAP. The purpose of the CMI phase is to design, construct, operate, maintain, and monitor the corrective measures (cleanup activities) recommended by LBNL in the Corrective

Measures Study (CMS) Report (LBNL, 2005a) and approved by the DTSC. These approved measures will reduce or eliminate the potentially adverse effects to human health or the environment caused by historic releases of chemicals to soil and groundwater at LBNL. On November 10, 2005, LBNL submitted its Draft RCRA Corrective Measures Implementation Workplan to the DTSC (LBNL, 2005b). The CMI workplan provides a detailed description of the design of the approved corrective measures.

1.3 DOCUMENTATION OF INVESTIGATION RESULTS

Results of environmental investigations that have been conducted at LBNL are documented in the following reports:

- Results of the initial environmental investigations at LBNL are described in the RCRA Facility Assessment (RFA) (LBNL, 1992a) and the RCRA Facility Investigation (RFI) Work Plan (LBNL, 1992b).
- Quarterly summaries of RCRA CAP activities conducted since January 1993 have been presented in the LBNL ERP Quarterly Progress Reports (LBNL, 1993-2005).
- Results of environmental investigations conducted from October 1992 through June 1994 are documented in the RCRA Facility Investigation Phase I Progress Report (LBNL, 1994a).
- Results of environmental investigations conducted from July 1, 1994 to June 30, 1995 are documented in the RCRA Facility Investigation Phase II Progress Report (LBNL, 1995a).
- Results of environmental investigations conducted from June 30, 1995 through September 22, 2000 are documented in the RCRA Facility Investigation Report (LBNL, 2000).

1.4 PROJECT ORGANIZATION

LBNL's various divisions manage and operate the laboratory facilities on site. The United States Department of Energy (DOE) provides funding and oversight of these operations. Investigations of areas that contain potential environmental contamination are conducted at LBNL under the ERP, which is part of a nationwide effort by the DOE to identify and clean up

contaminated areas at its facilities. The LBNL ERP is part of the Environmental Services Group of the LBNL Environment, Health and Safety (EH&S) Division.

SECTION 2

SITE DESCRIPTION

2.1 LOCATION

LBNL is located in the Berkeley/Oakland Hills in Alameda County, California (Figure 1). The western three-quarters of LBNL are in the city of Berkeley and the eastern quarter is in the City of Oakland.

2.2 SITE HISTORY AND OPERATIONS

LBNL is a research facility managed by the University of California (UC) for the DOE. From an initial emphasis on nuclear physics research in the 1940s, LBNL has diversified to include materials sciences, chemistry, earth sciences, biosciences, and energy conservation research. Many types of chemicals have been used at LBNL or have been produced as wastes, including gasoline, diesel, waste oils, polychlorinated biphenyls (PCBs), Freon, solvents, metals, tritium and other radionuclides, acids, etchants, and lead- and chromate-based paints.

The primary chemical contaminants detected in soil and groundwater at LBNL have been halogenated VOCs, principally tetrachloroethene (PCE), trichloroethene (TCE), carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1,1-trichloroethane (1,1,1-TCA), and 1,1-dichloroethane (1,1-DCA). Other contaminants detected in soil and/or groundwater include petroleum hydrocarbons, PCBs, metals, and tritium.

2.3 PHYSICAL DESCRIPTION OF THE SITE

A brief summary of the physiography, geology, and hydrogeology of the LBNL site is given below. More detailed descriptions are provided in the RCRA Facility Investigation Report (LBNL, 2000).

2.3.1 Physiography

The physiography of LBNL is dominated by a steep south- to southwest-facing slope (Figure 2) that has been modified by erosion of several steep stream canyons, by mobilization of landslides, and by extensive cut and fill operations associated with construction of LBNL facilities. Two westward flowing creeks drain the LBNL site (Figure 3): Strawberry Creek and its tributaries along the southern boundary of the site and North Fork Strawberry Creek, which drains the western portion of the site.

2.3.2 Geology and Hydrogeology

As shown on the bedrock geologic map (Figure 4a) and summary stratigraphic column (Figure 4b), LBNL is underlain primarily by northeast-dipping Cretaceous and Miocene sedimentary and volcanic bedrock units, and paleolandslide (ancient landslide) deposits composed of these units. Surficial units at LBNL consist primarily of artificial fill, colluvium, alluvium, and recent landslide deposits, as shown on the surficial geologic map (Figure 4c).

Groundwater flow and contaminant migration are controlled in large part by the geometry and physical characteristics of the surficial and bedrock units. Typical values of hydraulic conductivity for the geologic units mapped at the site are shown in the table below:

Typical Hydraulic Conductivity Ranges for Geologic Units at LBNL

Geologic Unit	Hydraulic Conductivity
Artificial Fill	10^{-6} to 10^{-8} m/s
Colluvium and alluvium	10^{-6} to 10^{-10} m/s
Moraga Formation (includes paleolandslide deposits)	10^{-4} to 10^{-6} m/s
Mixed Unit	10^{-5} to 10^{-9} m/s
Orinda Formation	10^{-5} to 10^{-13} m/s
San Pablo Group	10^{-6} to 10^{-8} m/s
Great Valley Group	10^{-5} to 10^{-8} m/s

m/s: meters per second

Groundwater elevation maps at LBNL show that the piezometric surface approximately mirrors surface topography. Groundwater flow directions generally follow the piezometric gradient, indicating that groundwater flow in the western portion of LBNL is generally westward, whereas flow in other parts of LBNL is generally southward.

2.4 SITE STUDY AREAS

For reporting purposes, the RCRA Facility Assessment (RFA) (LBNL, 1992a) subdivided LBNL into 15 Areas. Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) identified in the RFA were given designations based on their locations in one of the 15 Areas. Subsequently, during the RCRA Facility Investigation (RFI), the 15 Areas were regrouped into the following four areas, based on the locations of groundwater plumes, the direction of groundwater flow, and potential contaminant migration pathways. The locations of the four areas are shown on Figure 5.

- Bevalac Area (RFA Areas 1, 9 and 15).
- Old Town Area (RFA Areas 2, 7, 10, and 14).
- Support Services Area (RFA Areas 3, 4, and 5).
- Outlying Areas (RFA Areas 6, 8, 11, 12, and 13).

Figures and tables presented in this report are organized based on the four above listed study areas.

SECTION 3

TECHNICAL PROCEDURE DOCUMENTATION

3.1 PROGRAM PLANS AND GUIDANCE DOCUMENTS

RCRA CAP activities are conducted at LBNL in accordance with the following ERP written procedures and regulatory guidance documents:

LBNL ERP Procedures

- Vadose Zone Monitoring Plan (LBNL, 1991).
- Groundwater Sampling and Analysis Plan (LBNL, 1992c).
- Specifications for Site Restoration Program Environmental Monitoring Wells and Piezometers, Supplement B of the Well Management Work Plan (LBNL, 1992d).
- Health and Safety Program Plan (LBNL, 2004a).
- Quality Assurance Program Plan (QAPP) (LBNL, 1994b).
- Standard Operating Procedures (SOPs) (LBNL, 1994c).

Regulatory Guidance Documents

- California Department of Water Resources Well Standards (DWR, 1991).
- California Environmental Protection Agency Guidelines for Hydrogeologic Characterization of Hazardous Substance Release Sites and Guidance Manuals for Groundwater Investigations (CAL EPA, 1994a, 1994b).
- United States Environmental Protection Agency (USEPA) Guidance Documents for implementing RCRA Corrective Action Programs, RCRA Facility Investigations, and RCRA Interim Corrective Measures (USEPA, 1994, 1989, 1988).

3.2 LABORATORY PROCEDURES

All laboratories utilized by the LBNL ERP are certified by the California Department of Health Services (DHS) under the California Environmental Laboratory Accreditation Program. Laboratory quality control procedures include the analysis of method blanks and spike samples

in accordance with protocols established for specific United States Environmental Protection Agency (USEPA) analytical methods, and are specified in the LBNL QAPP (LBNL, 1994b).

3.3 GROUNDWATER MONITORING SCHEDULE

The groundwater monitoring program at LBNL is based on a schedule that is reviewed and approved by the San Francisco Bay Regional Water Quality Control Board (Water Board). The current schedule (LBNL, 2005c), which is based on requirements of the CMI, was approved by the Water Board in August 2005 (Water Board, 2005). The objectives of groundwater monitoring during CMI are to evaluate the effectiveness of corrective measures implemented for cleanup of groundwater contamination and to ensure that groundwater plumes are not migrating. To accomplish these objectives, wells are monitored for VOCs in the following areas:

- Where Media Cleanup Standards (MCSs) (cleanup levels) for groundwater are exceeded.
- Downgradient from areas of groundwater contamination.
- Near the downgradient site perimeter.

In addition to VOC monitoring, samples are collected from twelve groundwater monitoring wells and analyzed for inorganic elements (metals) of potential concern. The wells that are sampled and the specific analytes selected for monitoring are based on a comparison to background levels of inorganic elements in groundwater at LBNL (LBNL, 2002) and Maximum Contaminant Levels (MCLs) for drinking water.

Radionuclides, including tritium, are not regulated under RCRA and are therefore not included in the RCRA CAP: however, radionuclide contamination at LBNL is addressed under the oversight of the DOE. Although not regulated under RCRA, groundwater monitoring recommendations for tritium have been included in the revised groundwater monitoring requests that have been submitted to the Water Board. Concentrations of tritium have shown long-term declines in most monitoring wells in which it has been detected, and all measured concentrations in groundwater are currently below MCLs.

3.4 LBNL WORKPLANS

Environmental investigations were conducted during the RFI phase of the CAP based on requirements specified in the RFI workplans (LBNL, 1992b, 1994d, and 1995b) and RFI workplan addenda submitted to the regulatory agencies. In addition, LBNL has prepared numerous Interim Corrective Measures (ICM) and pilot test workplans, which were also submitted to the regulatory agencies. A list of these workplans and addenda completed through January 2000 is contained in the Final RFI Report (LBNL, 2000). Updates to the list are provided in the Quarterly Progress Report and Annual Status Summary reports (LBNL, 2003a, 2004b). Workplans submitted to the regulatory agencies during the current annual summary period are listed in the following table:

Workplans Submitted During Current Annual Summary Period (October 1, 2004 through September 30, 2005)

Workplan	Date Submitted	Reference
Proposal for Revised Groundwater Monitoring Schedule *(the document also proposed destruction of 61 groundwater monitoring wells that were no longer needed)*	May 6, 2005	LBNL, 2005c
Interim Corrective Measures Workplan for the Building 51/64 Groundwater Solvent Plume Source Area	June 15, 2005	LBNL, 2005d
Corrective Measures Implementation (CMI) Workplan for Soil Excavation, Building 51L Groundwater Solvent Plume Source Area	September 26, 2005	LBNL, 2005e

SECTION 4

ENVIRONMENTAL ACTIVITIES CONDUCTED DURING REPORTING PERIOD

4.1 ANALYTICAL METHODS

Soil and water samples collected during the current reporting period were analyzed by the LBNL Environmental Measurement Laboratory (EML), the LBNL Radiation Analytical Measurement Laboratory (RAML), Eberline, or BC Laboratories (BC), as indicated in the following table:

Analytical Methods and Laboratories for the Current Reporting Period

	ANALYTICAL LABORATORY	
Analytical Method	**Groundwater**	**Soil**
VOCs (EPA 8260)	EML/BC	BC
Title 22 metals (EPA 6000 & 7000 series), Chromium^{+6}	BC	
Fuel Identification, TPH-FI, TPH-D, TPH-G, and TPH-K (EPA Mod. 8015)	BC	
PCBs (EPA 8082)	BC	
Tritium (EPA 906)	RAML/Eberline	RAML

VOCs: Volatile organic compounds
TPH-G: Total petroleum hydrocarbons in the gasoline range
TPH-K: Total petroleum hydrocarbons in the kerosene range
TPH-D: Total petroleum hydrocarbons in the diesel range
TPH-FI: Total petroleum hydrocarbons fuel identification
PCBs: Polychlorinated biphenyls

The complete list of USEPA Method 8260 analytes and quantitation limits (assuming no sample dilution) for each laboratory is shown in Table 1. Quantitation limits for other analyses are included in the tables of results.

4.2 GROUNDWATER MONITORING RESULTS

Fourth quarter FY 2005 groundwater sampling started on July 5, 2005 and was completed on September 29, 2005. Groundwater samples are collected from groundwater monitoring wells and analyzed for VOCs, metals, and tritium in accordance with the schedule approved by the Water Board (LBNL, 2005c). Selected samples are also analyzed for PCBs and total petroleum hydrocarbons (TPH). Groundwater samples are also periodically collected from temporary groundwater sampling points, slope stability wells, groundwater extraction wells, and hydraugers. Locations of slope stability wells are shown on Figure 6. Locations of groundwater monitoring wells, temporary groundwater sampling points, extraction wells, and hydraugers are shown on Figures 7 and 8a through 8i. Slope stability wells and hydraugers were not installed for groundwater monitoring purposes, and therefore the results from these installations are not considered valid for quantitative determination of groundwater concentrations.

The sampling locations and analytical methods for groundwater sampling conducted during the current reporting period are presented in Table 2. The sampling results are discussed in the following sections. Water level data are presented in Table 3. Table 4 provides groundwater monitoring well construction details. The table numbers corresponding to the tables containing the groundwater analytical results for the different types of sampling locations are noted below:

Table Numbers for Groundwater Analytical Results

Chemicals	Area	Groundwater Monitoring Wells	Temporary Groundwater Sampling Points	Groundwater Extraction Wells	Other Locations	Hydraugers
Volatile Organic Compounds (VOCs)	Bevalac Old Town Support Services Outlying	5-1 6-1 7-1 8	5-2 6-2 7-2	5-3 6-3	5-4 6-4	10
Petroleum Hydrocarbons	Sitewide	12				
Tritium	Sitewide	13	13		13	
Metals	Sitewide	14	14		14	
PCBs	Sitewide	15	15			

Tables listing VOC concentrations are subdivided into halogenated non-aromatic compounds, which were primarily derived from solvents, and nonhalogenated or aromatic compounds, which were primarily derived from petroleum products. In order to simplify the VOC reporting tables, VOCs with extremely limited historical detections are listed in Table 9. No VOCs are included in Table 9 for the current reporting period. The locations where MCLs were exceeded during the current reporting period and the specific VOCs that exceeded MCLs are listed in Table 11.

During the RFI, ten groundwater contamination plumes were identified at LBNL. In addition to the plumes, five localized areas of solvent-contaminated groundwater were identified in the Support Services Area of LBNL. Seven of the ten plumes contain halogenated non-aromatic VOCs derived from industrial solvents, two contain diesel-range petroleum hydrocarbons, and one contains tritium. Two of the plumes, the Old Town Groundwater Solvent Plume and the Building 71 Groundwater Solvent Plume, have been subdivided into multiple lobes to reflect the commingling of contaminated groundwater derived from different sources. The following table lists figure numbers for contaminant concentration maps, groundwater elevation maps, and/or concentration trend plots for eight of the plumes, the five areas of solvent-contaminated groundwater, and monitoring wells in the Outlying Areas and along the site perimeter. The remaining two plumes (Building 71 Freon plume and Building 37 solvent plume) are not included in the table because contaminant concentrations previously declined to levels substantially below MCLs.

LBNL Groundwater Monitoring – Figure Index

Plume or Area of Groundwater Contamination	Figure Number		
	Concentration Map	Water Level Elevation Map	Concentration Trends
Halogenated Non-Aromatic VOCs			
Bevalac Area		11	
Building 71 Groundwater Solvent Plume			
Building 71 Lobe	10		12a
Building 71B Lobe	10		12b through 12d
Building 51/64 Groundwater Solvent Plume	10, 14		15a through 15e
Building 51L Solvent Plume	10, 16		17
Old Town Area		20	
Old Town Groundwater Solvent Plume			
Building 7 Lobe	18, 19		22a through 22f
Building 52 Lobe	18		23a through 23c
Building 25A Lobe	18		24a and 24b
Support Services Area		27	
Building 76 Groundwater Solvent Plume	26		28
Building 69A, 75/75A, 75B, and 77 Areas of Groundwater Contamination	26		29a through 29d
Outlying Areas and Perimeter Monitoring Wells	30		
Petroleum Hydrocarbons			
Building 7 Diesel Plume		20	31
Building 74 Diesel Plume			32
Tritium			
Building 75 Tritium Plume (SWMU 3-7)	33, 34	27	35a through 35f
Building 71 Area	33		36

Section 4.2.1 describes monitoring of VOC-contaminated groundwater on an area-by-area basis. Sections 4.2.1.1 through 4.2.1.4 describe the Bevalac, Old Town, and Support Services, and Outlying Areas, respectively. Section 4.2.1.5 describes the VOC monitoring results for the site-perimeter monitoring wells. No VOCs were detected in either perimeter or Outlying Area monitoring wells during the current reporting period. Results for other analytes are provided in Section 4.2.2 (petroleum hydrocarbons), Section 4.2.3 (tritium), 4.2.4 (metals), and 4.2.5 (PCBs).

4.2.1 Status of Groundwater Monitoring – Halogenated Non-Aromatic VOCs

The status of, and long-term concentration trends for, each of the groundwater VOC plumes and other localized areas of VOC-contaminated groundwater are discussed in the following

subsections. VOCs detected at concentrations above MCLs during the current reporting period are listed in Table 11 and summarized in the following table. Areas of groundwater contamination where MCLs are exceeded are shown on Figure 9.

Maximum Concentrations (µg/L) of Halogenated VOCs Detected Above MCLs During the Fourth Quarter of FY05

Area	Groundwater Unit	1-1 DCA	1-2, DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	meth chloride	PCE	TCE	vinyl chloride	carbon tet
	MCL	**5**	**0.5**	**6**	**6**	**10**	**5**	**5**	**5**	**0.5**	**0.5**
Bevalac	Building 71B Lobe				56			249	42	16	
	Building 51/64 Plume	1750	7.6	603	267	48		393	201	22	
	Building 51L Plume	100		21	643	70		9.5	310	400	
	SB64-03-13	9									
	SB51A-01-8B				28			7.4	331		3.2
Old Town	Old Town Plume Building 7 Lobe	32		340	340	12	500	42,000	33,000	3.6	1,900
	Building 25A			19				39	161		1.5
	Building 52 Lobe							25	12		4.2
Support Services	Building 69A Area				44					52	
	Building 75A Area				43				7.4		
	Building 76 Area								15		

DCA: dichloroethane
DCE: dichloroethene
PCE: tetrachloroethene
TCE: trichloroethene

4.2.1.1 Bevalac Area

Isoconcentration contours for total halogenated hydrocarbons in groundwater in the Bevalac Area during the current reporting period are shown on Figure 10. The water level elevation map of the Bevalac Area for the current reporting period is shown on Figure 11. Four groundwater plumes have been identified in the Bevalac Area: the Building 71 Freon Plume, the Building 71 Groundwater Solvent Plume, the Building 51/64 Groundwater Solvent Plume, and the Building 51L Groundwater Solvent Plume. The geometry and distribution of chemicals in the Building 71 plume indicate that it consists of two lobes (Building 71 and Building 71B) that were originally discrete plumes derived from distinct sources but now coalesce just north of Building 46A.

Building 71 Solvent Plume Building 71 Lobe

Description

The Building 71 lobe originates south of Building 71 and contains primarily TCE.

ICMs, Pilot Tests, and Corrective Measures

No corrective measures were required for the Building 71 lobe since concentrations of VOCs in groundwater have been below MCLs since July 2003. Therefore this unit is not included in the CMI phase of the CAP.

Contaminant Concentration Trends

Concentration trends of total halogenated VOCs detected in wells monitoring the Building 71 lobe are plotted on Figure 12a. The plot excludes Freon-113, which is derived from the commingled Freon plume, and chloroform and bromodichloromethane, which are present as the result of an East Bay Municipal Utility District (EBMUD) water pipeline leak (LBNL, 2000). The leak was repaired in 1996. The reemergence of chloroform in MW71-93-2 in February 2004 indicates the presence of a new EBMUD water pipeline leak near Building 71. Concentrations of VOCs detected in wells monitoring the Building 71 lobe (MW71-93-2 and MW71-97-23) have shown a decreasing trend since the end of 2000.

Building 71 Solvent Plume Building 71B Lobe

Description

The Building 71B lobe extends southwest from Building 71B toward the Building 51/64 area. The principal plume constituents are halogenated VOCs that were used as cleaning solvents, including TCE and PCE, and their associated degradation products (e.g. cis-1,2-DCE). Solvent spills that occurred at the location of Building 71B appear to be the primary source for the contamination.

ICMs, Pilot Tests, and Corrective Measures

Excavation and disposal of contaminated soil from beneath and south of Building 71B was completed as an ICM in several phases between 2000 and 2004. This soil was the source of the

Building 71B lobe groundwater contamination. In 2003 and 2004, an in situ chemical oxidation (ISCO) pilot test was conducted in the source area at Building 71B and an enhanced bioremediation pilot test using Hydrogen Release Compounds (HRC®) was conducted upgradient from monitoring well MW71B-98-13 adjacent to the source area. HRC injection was effective in reducing VOC concentrations in the groundwater; however, ISCO did not appear to have been effective.

Since September 2004, water has been injected into the gravel-backfilled ICM excavation located east of the concrete deck at the entrance to the Building 71B for the purpose of flushing the residual soil contamination (in situ soil flushing). The injected water is extracted at downgradient temporary groundwater sampling point SB71B-04-1, treated by GAC, and then reinjected in the source area. Since December 2004, HRC has been periodically added to the injected water to help expedite in-situ biodegradation.

To prevent the migration of contaminated groundwater to surface water, contaminated effluent from the 51-01-series hydraugers is piped into a granular activated carbon (GAC) treatment system located east of Building 51. The locations of the hydraugers are shown on Figure 10. The treated water is discharged to the sanitary sewer.

Continued operation of in situ soil flushing with the addition of HRC in the source area and continued collection and treatment of contaminated hydrauger effluent are corrective measures approved for the Building 71B lobe.

Contaminant Concentration Trends

Concentration trends of total halogenated VOCs detected in wells monitoring the Building 71B lobe are plotted on Figures 12b through 12d. Concentrations of VOCs in the wells in the source and upgradient core areas have declined significantly since HRC injection/soil flushing was started (Figure 12b and Figure 12c). These results indicate that HRC has been effective in expediting the degradation process. In addition, a long-term decline in concentrations has been observed in wells MW90-3, MW90-4, and MW90-5, monitoring the downgradient portion of the Building 71B lobe (Figure 12d).

Building 71 Freon Plume

Description

The Building 71 Freon Plume is defined by the presence of 1,1,2-trichloro-1,2,2-trifluoroethane (Freon-113), primarily in MW71-93-2 and MW71-94-1. This plume extends southwards from the west end of Building 71 and is commingled with the Building 71 Lobe of the Building 71 Solvent Plume.

ICMs, Pilot Tests, and Corrective Measures

No corrective measures were required for the Building 71 Freon Plume since concentrations of VOCs in groundwater have been below MCLs since 1994. Therefore this unit is not included in the CMI phase of the CAP.

Contaminant Concentration Trends

Freon concentrations in the Building 71 Freon Plume have declined from a maximum of almost 9,000 µg/L in 1994 to less than 5 µg/L currently (Figure 13). The MCL for Freon-113 is 1,200 µg/L.

Building 51/64 Solvent Plume

Description

The Building 51/64 Solvent Plume extends from the source area near the southeast corner of Building 64 westwards beneath Building 51B (Figures 10 and 14). The principal plume constituents are halogenated VOCs that were used as cleaning solvents, including 1,1,1-TCA, TCE, PCE, and their associated degradation products (e.g. 1,1-DCE, 1,1-DCA, cis-1,2-DCE, and vinyl chloride). The principal source of the plume was likely the Building 51/64 Former Temporary Equipment Storage Area (AOC 9-12), although other sources in the Building 51/64 area may have contributed to the plume.

ICMs, Pilot Tests, and Corrective Measures

To prevent the discharge of contaminated Building 51 subdrain water to the creek, an ICM was implemented in 1996 that routes water from the Building 51 subdrain system to a groundwater treatment system. The treated groundwater is then discharged to the sanitary sewer.

In September 2000, approximately 180 cubic yards of contaminated soil were excavated from the source area near the southeast corner of Building 64 as an ICM, and a groundwater extraction well was installed in the backfilled excavation. In October 2003, an in situ soil flushing pilot test was started in the source area. The test consisted of an injection trench inside Building 64 and an extraction trench along the southern end of the northeast side of the Building.

During the current reporting period, a second groundwater collection trench was constructed on the southeast side of Building 64. The purpose of the new trench is to provide additional control on the migration of water injected inside Building 64 and control the southward migration of contaminated groundwater from the plume source area. The trench was constructed by drilling adjacent large diameter borings, and is 28 feet deep, 48 feet long, and approximately 2 feet wide. A 31-foot-deep extraction well (EW64-05-1) was installed at the northeast end of the trench. The trench was backfilled with gravel except for the upper 3 feet, which was backfilled with lean concrete overlain by a concrete slab at the surface. Also during the current reporting period, temporary groundwater sampling point SB64-05-4 was constructed on the southwest side of Building 64. The well was installed to monitor the potential migration of contaminated groundwater from Building 64 towards the southwest, and to assess whether the design of the new groundwater collection trench along the southeast end of Building 64 is sufficient to capture the water flowing southward from the injection trench. Based on the initial results from this well, it was converted into a groundwater extraction well to aid in capturing contaminants migrating from beneath Building 64.

The in situ soil flushing system currently consists of extraction of groundwater from the two collection trenches, from three wells (SB64-98-8, SB64-99-5, and SB64-00-1) inside Building 64, and from SB64-05-4 installed outside the southwest corner of the building. The extracted groundwater is treated to non-detectable levels of VOCs and recirculated to the injection trench inside Building 64. Groundwater is also extracted and treated from the backfilled ICM excavation in the source area. The configuration of the system is shown on Figure 14.

Continued operation of the in situ soil flushing system and collection and treatment of the subdrain water are the corrective measures approved for the Building 51/64 Groundwater

Solvent Plume. Monitored Natural Attenuation (MNA) is an additional corrective measure approved for the plume. MNA has not yet been implemented.

In addition to the corrective measures described above, four HRC injection wells were constructed on the east side of former Building 51B in the downgradient core area of the Building 51/64 plume upgradient from groundwater monitoring wells MW51-96-16 and MW51-96-17. About 300 pounds of HRC were injected in February 2005 as a pilot test. Monitoring of the performance of the test continued during the current reporting period. About 150 gallons of warm water per week are currently being pumped into the injection wells to help flush the HRC into the formation.

Contaminant Concentration Trends

Concentration trends of total halogenated VOCs detected in wells monitoring the Building 51/64 Groundwater Solvent Plume are plotted on Figures 15a through 15e. Concentrations of VOCs detected in the plume source area decreased significantly after the source area ICM excavation was completed, and have declined further since in situ soil flushing was started in 2003 (Figures 15a and 15b). Before implementation of the source area ICM, halogenated VOCs were detected in groundwater in the source area at total concentrations above 700,000 μg/L, with 1,1,1-TCA comprising approximately 90% of the contaminant mass. The concentration of total halogenated VOCs currently detected in groundwater in the source area is approximately 2,000 μg/L or less, with 1,1-DCA the primary VOC detected.

There has also been a long-term decreasing trend in the concentrations of VOCs detected in MW51-96-16 in the plume core since the source area ICM excavation was completed (Figure 15c). No trends are apparent in the concentrations of VOCs in other wells monitoring the plume, with the exception of a decrease in the concentration of vinyl chloride in MW56-98-2, as shown in Table 5-1.

Building 51L Solvent Plume

Description

The Building 51L Solvent Plume is centered near the southwest corner of Building 51L (Figures 10 and 16). The principal plume constituents are halogenated VOCs that were used as

cleaning solvents, including TCE, PCE, and associated degradation products (e.g., cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride). Based on the results of soil and groundwater sampling, solvent spills that occurred near the former location of Building 51L appear to be the primary source for the soil and groundwater contamination. The groundwater contamination is primarily limited to the artificial fill and colluvium and has generally not been detected in the underlying bedrock. In addition to the plume described above, relatively low concentrations of TCE (below MCLs) have been detected in well MW51-98-5, to the north of the plume area.

ICMs, Pilot Tests, and Corrective Measures

An ISCO pilot test was conducted in the Building 51L plume source area in 2003.

Groundwater has been extracted from well EW51L-99-1 and/or EW51L-00-1 in order to ensure that contaminated groundwater does not infiltrate into an adjacent storm drain catch basin where it could potentially migrate to surface water.

The corrective measures approved for the Building 51L plume are MNA, excavation of contaminated source area soils, and reconstruction of the storm drain to prevent inflow of contaminated groundwater. These measures have not yet been implemented.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in wells monitoring the Building 51L Groundwater Solvent Plume are shown on Figure 17. Concentrations of VOCs detected in SB51L-98-1A and SB51L-02-3 located near the southwest corner of Building 51L showed a generally increasing trend through approximately September 2003 (Figure 17). The increase in concentrations is attributed to operation of extraction well EW51L-00-1, located within approximately 15 to 20 feet of the wells, which may have drawn higher concentration groundwater towards the two sampling points.

4.2.1.2 Old Town Area

The Old Town Groundwater Solvent Plume is a broad, multi-lobed groundwater plume that underlies much of the Old Town area. The geometry and distribution of chemicals in the

plume indicate that it consists of three coalescing lobes (Building 7, Building 52, and Building 25A) that were originally discrete plumes derived from distinct sources. In addition, there is a small plume of contaminated groundwater near Building 37, toward the south. The isoconcentration contour map for total halogenated hydrocarbons detected in groundwater in the Old Town Area during the current reporting period is shown on Figure 18. A more detailed map of the Building 7 lobe is shown on Figure 19. A water level elevation map of the Old Town Area for the current reporting period is shown on 20.

Old Town Groundwater Solvent Plume - Building 7 Lobe (AOC 2-4)

Description

The Building 7 lobe contains significantly higher VOC concentrations than the other two plume lobes and extends northwestward from the northwest corner of Building 7 to the parking area downslope from Building 58 (Figure 19). The principal lobe constituents are halogenated VOCs that were used as cleaning solvents, including PCE and carbon tetrachloride, and their associated degradation products (e.g. TCE, 1,1-DCE, cis-1,2-DCE, and vinyl chloride). Leaks and/or overflows of halogenated hydrocarbons (primarily PCE) from an abandoned sump (the Former Building 7 Sump [AOC 2-5]) were the source of the contamination.

ICMs, Pilot Tests, and Corrective Measures

Beginning in 1992, ICMs were implemented where they were determined to be necessary to protect human health and the environment. In addition, pilot testing was conducted to evaluate the effectiveness and implementability of potential remedial technologies. Following is a list of pilot tests and ICMs that have been implemented to manage the Building 7 lobe:

ICMs and Pilot Test for Building 7 Lobe

Date	Location	Comments
Excavation and Removals		
1992	Source location	Removal of the contents (free product) in the Building 7 Sump, the source of the Building 7 lobe.
1995	Source location	Removal of the Building 7 Sump and excavation of source area soil to a depth of 17 feet to remove highly contaminated soil and free product.
In-Situ Soil and/or Saturated Zone Flushing		
1996	Source zone immediately	Groundwater extraction from the Building 7 Groundwater

ongoing	downgradient from the Former Building 7 Sump location	Collection Trench. Treatment of extracted groundwater with GAC and recirculation of the treated water into the gravel-filled sump excavation. Method has been effective in reducing concentrations of contaminants in the groundwater and soil in the source zone and controlling downgradient migration.
1998 ongoing	Leading edge	Extraction of groundwater from the Building 58 West Groundwater Collection Trench at the downgradient edge of Building 7 lobe. Installed to control migration of the downgradient edge of the Building 7 lobe.
1999 ongoing	Core zone	Extraction of groundwater and soil gas from the Building 53/58 Slope Collection Trench. Starting in October 2003, treated groundwater was discharged on the slope above the collection trench to flush the downslope core zone. Method has been effective in controlling downgradient migration of the core zone.
2002 ongoing	Downgradient edge of the core zone	Extraction of groundwater from Building 58 East Groundwater Collection Trench. Method has been effective in controlling downgradient migration of the core zone.
2002-ongoing	Core zone downgradient from the Building 7 Groundwater Collection Trench.	Treated groundwater is injected into the six-well injection system (IW7-02-1 through IW7-02-6) south of Building 53 and onto the slope west of Building 53. The injected water is captures at three downgradient extraction wells and from the upgradient collection trench. Method has been effective in reducing contaminant concentrations in the upgradient core area.
Thermally Enhanced Soil Vapor Extraction Pilot Test		
2001 to 2004	Source zone immediately downgradient from the Former Building 7 Sump	Conductive electrical heating of soil in three boreholes combined with extraction of both soil vapor and groundwater from one central and three peripheral extraction wells. The test was ended on November 1, 2004 when the heaters were permanently turned off. Method was effective in removing contaminant mass from the source zone
Migration Control Compliance Measure		
1998	Building 7 lobe periphery zone west of Building 58	A drain line was plugged and a sump was installed to capture contaminated effluent to eliminate the potential migration of contaminated water through the drain system to surface water.

Dual-phase extraction well HG7-00-1 was destroyed by overdrilling during the current reporting period. The well was located in the center of the thermally enhanced soil vapor extraction pilot test area.

The primary approved corrective measure for the core of the Building 7 lobe is in situ soil flushing. Therefore, operation of the existing in situ soil flushing system for the Building 7 lobe will continue as part of the long-term corrective action. The configuration of this system is shown on Figure 21, and consists of groundwater injection wells, a groundwater injection trench, groundwater extraction trenches, and groundwater extraction wells. The groundwater collection trench located at the southeast corner of Building 58 and to the west of Building 58 and the dual phase extraction wells on the Building 53/58 slope will also continue as approved corrective measures. MNA is an additional corrective measure approved for the Building 7 lobe, but has not yet been implemented.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs in wells monitoring the Building 7 lobe are shown on Figures 22a through 22f. The concentrations of VOCs detected in most wells monitoring the source, core, and transgradient areas of the Building 7 lobe have declined since in situ soil flushing began in the source area in 1997 (Figures 22a through 22d). Significant declines in concentrations also occurred after the start of in situ soil flushing in the core area and after discharge of treated groundwater began on the Building 53/58 slope for soil flushing.

The most marked long-term decline in concentrations has been observed in monitoring well MW7B-95-21, which is located between the Former Building 7 Sump and the Building 7 Groundwater Collection Trench. The concentration of total halogenated VOCs detected in MW7B-95-21 has declined from approximately 300,000 µg/L to approximately 1,000 µg/L or less (Figure 22f). This decline is attributed primarily to the effects of soil flushing. Concentrations have remained low since soil flushing was halted at the beginning of 2003. Concentration trends in downgradient wells (e.g. MW58A-94-14) have been variable (Figure 22e), although recent trends appear to be relatively stable or show decreasing concentrations.

Concentrations of VOCs detected in soil water samples collected from lysimeters in the heater-test instrument wells (HI7-001 and HI7-002) continue to remain high. Lysimeter samples collected during the current reporting period contained PCE at maximum concentrations of 87,200 µg/L in HI7-00-1 and 75,300 µg/L in HI7-00-2, both at a depth of 40 feet (Table 6-4).

These relatively high concentrations of PCE are believed to have resulted from condensation of VOCs that were vaporized by the heating process.

Old Town Solvent Plume - Building 52 Lobe

Description

The Building 52 lobe extends northwestward from the area east of Building 52A to the east side of Building 46, where it is intercepted by the Building 46 subdrain (Figure 18). The principal lobe constituents are halogenated VOCs that were used as cleaning solvents, including PCE and carbon tetrachloride, and their degradation products (e.g. TCE, 1,1-DCE, cis-1,2-DCE, and chloroform). Several of the primary plume constituents were detected in soil samples collected east of Building 52A, suggesting that a release in this area may have constituted the primary plume source.

ICMs, Pilot Tests, and Corrective Measures

Groundwater at the downgradient edge of the Building 52 lobe is intercepted by a subdrain located on the east side of Building 46, and treated using a GAC system. The subdrain was originally installed as part of a landslide mitigation measure and collects subsurface water draining from the hillside to the east.

A groundwater contaminant source was inferred to be present east of Building 52A based on evaluation of VOC concentrations in groundwater samples and groundwater gradient data. Based on this information, contaminated soil was excavated from this area as an ICM in 2001. In May 2003, in situ soil flushing was initiated to flush contaminants from the source area. Continued operation of the in situ soil flushing and continued extraction and treatment of groundwater from the Building 46 Subdrain are approved corrective measures for the Building 52 lobe. The soil flushing system consists of five wells used for groundwater injection (IW5-04-1, IW5-04-2, SB52A-98-1, IW27-04-1, and IW7C-04-1), four wells used for groundwater extraction (MW52A-98-8B, MW52-95-2B, EW53-04-2, and EW7C-04-2), and the Building 46 subdrain. Groundwater extracted from MW52A-98-8B, MW52-95-2B, and EW53-04-2 is treated at the Building 53 GAC system and water from the subdrain is treated at the Building 46 GAC system. The treated water is recirculated for additional flushing. The configuration of the

Building 52 lobe in situ soil flushing system and the location of the Building 46 subdrain are shown on Figure 21.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs in wells monitoring the Building 52 lobe are shown on Figures 23a through 23c. The concentrations of VOCs detected in most wells monitoring the Building 52 lobe have declined since in situ soil flushing began in 2003, with concentrations of VOCs in wells in the source area declining to levels below MCLs.

Old Town Solvent Plume - Building 25A Lobe

Description

The Building 25A lobe extends from Building 25A towards Buildings 7 and 16 (Figure 18), with the highest contaminant concentrations detected in groundwater near the western end of Building 25A. In addition, a segment of this lobe extends southwards beneath Building 25. The principal lobe constituents are halogenated VOCs that were used as cleaning solvents, including TCE, PCE, and carbon tetrachloride and their degradation products (e.g. 1,1-DCE, cis-1,2-DCE, and chloroform). Groundwater sampling results indicate that the source area was near the western end of Building 25A; however, a specific source has not been identified.

ICMs, Pilot Tests, and Corrective Measures

A groundwater collection trench was installed west of Building 25A in 2002 to control migration of contaminated groundwater from the source area. Extraction, treatment, and recirculation of water from the trench to help flush contaminants from the soil were started on April 17, 2002. The treated water is recirculated into a shallow gravel infiltration bed that was constructed upgradient of the trench between Buildings 25A and 44. Groundwater is also being extracted and treated from monitoring well MW25A-98-3. Contaminated water has also been extracted and treated from an electrical utility manhole near Building 6 as an ICM, to prevent the migration of contaminated water through the utility conduits.

Continued operation of the in situ soil flushing system and continued extraction and treatment of contaminated water from the electrical utility manhole are corrective measures

approved for the Building 25A lobe. The configuration of the Building 25A lobe in situ soil flushing system is shown on Figure 21. MNA is an additional corrective measure approved for the Building 7 lobe, but has not yet been implemented.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in wells monitoring the Building 25A lobe are shown on Figure 24a and 24b. The concentrations of VOCs detected in wells monitoring the Building 25A lobe source area have declined since in situ soil flushing began in 2002 (Figure 24a). The concentrations of total VOCs detected in MW25A-98-3 and MW25A-98-1 have decreased from approximately 250 µg/L to about 50 µg/L. Concentrations in several downgradient wells have also been declining (Figure 24b).

Building 37 Groundwater Solvent Plume (AOC 14-5)

Description

Halogenated non-aromatic VOCs, primarily TCE and PCE, have been detected in wells MWP-7 and MW37-92-6 near Building 37 (Figure 18). The source of the plume is uncertain, although contaminated groundwater derived from the Old Town Plume may have migrated to this area through underground utilities east of Building 6 and/or a drainage pipe. Groundwater in this area flows generally southward (Figure 20).

ICMs, Pilot Tests, and Corrective Measures

To control contaminant migration, groundwater was extracted from MWP-7 and MW37-92-6 beginning in January 1994. The extracted water was combined with effluent from drain 37-01-01 and from nearby underground utilities (manhole EMH 133), treated using a GAC system, then used as makeup water for the Building 37 cooling tower. Extraction from the two wells was stopped on June 4, 2001 because contaminant concentrations had declined to levels below MCLs in both wells.

No corrective measures were required for the Building 37 plume since concentrations of VOCs in groundwater have been below MCLs since 2000. Therefore this unit is not included in the CMI phase of the CAP.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in MWP-7 and MW37-92-6 are shown on Figure 25. Concentrations of halogenated VOCs have declined in wells MWP-7 and MW37-92-6 since groundwater extraction was initiated in March 1994. The only VOC detected in the plume since January 2003 has been TCE in well MWP-7. The concentration of TCE in MWP-7 has declined to below or only slightly above the detection limit of 1 µg/L.

4.2.1.3 Support Services Area

The isoconcentration contour map for total halogenated hydrocarbons detected in groundwater in the Support Services Area during the current reporting period is shown on Figure 26. The water level elevation map of the Bevalac Area for the current reporting period is shown on Figure 27. Hlogenated VOCs have been detected in several localized areas within the Support Services Area, generally at lower concentrations than in the plumes described in the preceding sections. Although the chemicals detected are all solvent-related, the specific contaminant suites detected within each of these localized areas generally differ, indicating discrete sources.

The following table lists the areas of halogenated VOC contaminated groundwater in the Support Services Area, the principal groundwater contaminants, and wells in which they have been detected:

Principal Halogenated VOCs Detected in Groundwater in Support Services Area

Subarea	Primary Contaminants	Monitoring Wells
Building 76	TCE and cis-1,2-DCE	MW76-1 and MW76-98-21
Building 75/75A	TCE and cis-1,2-DCE	MW75-96-20, MW75-99-7, SB75-02-1
	1,1-DCE	MW75-98-14
Building 69A	cis-1,2-DCE, vinyl chloride	MW69-97-8, SB69A-99-1
Building 75B	1,1-DCA and 1,1-DCE	MW75-97-5
Building 77	cis-1,2-DCE, 1,1-DCA, 1,1-DCE	MW91-2

Building 76 Groundwater Solvent Plume - AOC 4-5

Description

The Building 76 Solvent Plume extends approximately 100 feet southwards from the motor pool area on the south side of Building 76 (Figure 26). The principal plume constituent is TCE (a cleaning solvent) and its degradation products (e.g. cis-1,2-DCE). The Building 76 Motor Pool Collection Trenches and Sump (SWMU 4-3) are suspected to be the primary sources of contamination; however, the source has not been confirmed. Relatively low levels of TCE (approximately 2 µg/L or less) have also been detected sporadically in well MW78-97-20, located north of Building 76, although this contamination is interpreted to be discrete from the Building 76 plume.

ICMs, Pilot Tests, and Corrective Measures

During the second quarter of FY05, a sink, a floor drain, and a drainpipe inside Building 76 were investigated as potential sources for the groundwater contamination. Based on the results of soil sampling and visual observations during excavation and exposure of the utilities, the source for the contamination was not identified.

No corrective measures were required for the Building 76 Groundwater Solvent Plume since chemical concentrations have been below risk-based MCSs and groundwater characteristics do not meet SWRCB criteria as a source of drinking water (SWRCB Resolution 88-63). However, groundwater monitoring will continue in accordance with the monitoring well schedule approved by the Water Board (LBNL, 2005c) since concentrations exceed MCLs.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in wells monitoring the Building 76 Groundwater Solvent Plume are illustrated on Figure 28, and have shown no consistent trends. VOCs have been below or only slightly above the detection limit of 1 µg/L in downgradient monitoring well MW76-98-22, with no VOCs detected since March 2001 (Figure 28). No VOCs have been detected since August 2003 in MW78-97-20, located upgradient of the plume.

Building 69A Area of Groundwater Contamination

Description

The principal groundwater contaminants are degradation products (e.g., cis-1,2-DCE and vinyl chloride) of halogenated VOCs that were used as cleaning solvents. The most likely source of the contamination was leakage from a pipeline in the Building 69A Hazardous Materials Storage and Delivery Area (AOC 3-1) that drains to the Building 69A Storage Area Sump (SWMU 3-5). A dislocation observed in one of the sump drainpipes was repaired in 1987.

ICMs, Pilot Tests, and Corrective Measures

MNA is the corrective measure approved for the Building 69A Area of Groundwater Contamination. In 2005, a four-inch-diameter well (SB69A-05-1) was installed into the gravel-backfilled former UST excavation in the source area of the plume. The purpose of this well was to allow the injection of HRC. In late August 2005, HRC injection was started as an enhanced bioremediation measure. Approximately 90 gallons of HRC mixture has been injected each week. The HRC mixture used for injection is generated by mixing approximately 45-gallon batches of GAC-treated EBMUD drinking water with 2 to 4 pounds of HRC, heating the mixture, and allowing it to sit for two to four days prior to injection.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in wells monitoring the Building 69A Area of Groundwater Contamination are shown on Figure 29a. The concentration of VOCs (cis-1,2-DCE) has been decreasing in MW69-97-8 and SB69A-00-1. Concentrations of VOCs detected in SB69A-99-1 have remained relatively stable since 2001.

Building 75/75A Area of Groundwater Contamination

Description

There are two relatively small areas where halogenated VOCs have been detected in the groundwater near Buildings 75 and 75A (Figure 26). One area extends southward from the east side of Building 75A toward Building 75. The other area is located between Building 75 and 75A. The two areas may commingle near the northeast corner of Building 75. The contamination may be related to operations of the Building 75 Former Hazardous Waste Handling and Storage Facility; however, the source has not been confirmed.

ICMs, Pilot Tests, and Corrective Measures

In January 2004, an HRC pilot test was conducted southeast of Building 75A in the Building 75A area of groundwater contamination. HRC was injected into four borings that were drilled upgradient from temporary groundwater sampling point SB75-02-1, where the highest concentrations of VOCs in groundwater had been detected. The concentration of cis-1,2-DCE detected in groundwater samples collected from SB75-02-1 increased sharply after the start of the test, with concentrations of other VOCs remaining relatively stable. The increase in the concentration of cis-1,2-DCE may indicate that HRC was effective in degrading more highly chlorinated VOCs such as TCE.

No corrective measures are required for the Building 75/75A Area of Groundwater Contamination since chemical concentrations have been below risk-based MCSs and groundwater characteristics do not meet SWRCB criteria as a source of drinking water (SWRCB Resolution 88-63). However, groundwater monitoring will continue in accordance with the monitoring well schedule approved by the Water Board (LBNL, 2005c) since concentrations exceed MCLs.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in wells monitoring the Building 75/75A Area of Groundwater Contamination are shown on Figure 29b (Building 75A area) and Figure 29c (Building 75 area). Concentrations of VOCs in MW75-98-14, which monitors the Building 75 area, have generally been below MCLs. Except for an apparent increase in concentrations of VOCs in SB75-02-1 after HRC was injected in February 2003, there are no trends evident in the wells that monitor the Building 75A area (MW75-96-20, MW75-99-7, and SB75-02-1).

Building 75B Area of Groundwater Contamination

Description

Relatively low concentrations of halogenated VOCs have been detected in monitoring well MW75-97-5 located south of Building 75B.

ICMs, Pilot Tests, and Corrective Measures

No corrective measures are required for the Building 75B Area of Groundwater Contamination since concentrations of VOCs in groundwater have never exceeded MCLs. Therefore this unit is not included in the CMI phase of the CAP.

Building 77 Area of Groundwater Contamination

Description

A relatively small area of halogenated VOC contaminated groundwater is located south of Building 77 near MW91-2.

ICMs, Pilot Tests, and Corrective Measures

No corrective measures are required for the Building 77 Area of Groundwater Contamination since chemical concentrations have been below risk-based MCSs and groundwater characteristics do not meet SWRCB criteria as a source of drinking water (SWRCB Resolution 88-63). However, groundwater monitoring will continue in accordance with the monitoring well schedule approved by the Water Board (LBNL, 2005c) since concentrations exceed MCLs.

Contaminant Concentration Trends

Concentration trends for total halogenated VOCs detected in MW91-2 are shown on Figure 29c. Concentrations of both total VOCs and the individual chemicals have consistently declined since 1992, with concentrations decreasing to levels below the detection limit (trans-1,2-DCE and 1,1-DCE), below MCLs (1,1-DCA), or ranging from slightly above to below MCLs (cis-1,2-DCE). Cis-1,2-DCE (4.0 µg/L during the current reporting period) has not exceeded the MCL for the past three consecutive quarters.

4.2.1.4 Outlying Areas

The Outlying Areas include three geographically separate subareas (Figure 30):

- The Western Outlying Area contains the Building 50/70 complex and Building 88.

- The Northeastern Outlying Area, known as the Life Sciences Area, contains the Building 74/83/84 complex and Building 85.
- The Southeastern Outlying Area contains the Building 62/66 complex and Building 73.

No groundwater VOC plumes have been identified in the Outlying Areas and no Halogenated VOCs have been detected in any Outlying Area wells since July 2003.

4.2.1.5 Perimeter and Offsite Wells

A number of monitoring wells at LBNL were constructed to monitor potential offsite contaminant migration. These wells are located within or downgradient to the four study areas described in the preceding sections and sampling data pertaining to them are therefore included on the figures and in the tables associated with those areas. No VOCs were detected in any of these wells during the current reporting period. Historical sampling results are summarized below:

- MWP-1 is located in the Blackberry Creek parking lot and is used to monitor the quality of groundwater flowing offsite toward North Fork Strawberry Creek (Figure 8e). No VOCs have been detected in MWP-1.

- MWP-2 monitors the quality of groundwater flowing off-site south of Building 70A near the head of Cafeteria Creek (Figure 7). Except for an anomalous detection of PCE in March 1993 and July 1996, no VOCs have been detected in MWP-2.

- MWP-4, MWP-5, MWP-6, and MWP-7 (Figure 8a) monitor groundwater flowing off-site near the heads of several ravines draining the LBNL site. MWP-4 is at the head of a ravine flowing to Cafeteria Creek. MWP-5 is at the head of a ravine southwest of Building 10. MWP-6 and MWP-7 are near the head of Ravine Creek.

  No VOCs have been detected in MWP-4 and only anomalous detections of VOCs have been reported in MWP-5 (3 out of 50 sampling events) or MWP-6 (1 out of 48 sampling events). However, as discussed in Section 4.2.1.2, the Building 37 Solvent Plume has impacted well MWP-7. Concentrations of VOCs detected in MWP-7 declined after groundwater extraction was initiated as an ICM in March 1994 and have been less than MCLs since February 2000.

- MWP-8 monitors the quality of groundwater near the head of Ten-Inch Creek south of Building 48 (Figure 8a). Except for anomalous detections of toluene and PCE in March 1993 and PCE and TCE in January 2003, no VOCs have been detected in MWP-8.

- MWP-9, MWP-10, and MW77-97-11 monitor groundwater near the head of Chicken Creek south of Building 77 (Figure 8h). Except for a trace concentration (0.82 µg/L) of Freon-113 in December 1994, VOCs have not been detected in MWP-10. PCE, TCE, cis-1,2-DCE and carbon tetrachloride were sporadically detected in MWP-9 between February 1996 and February 1997, but except for a trace concentration of TCE (1.1 µg/L) in July 2003, have not been detected since. It is suspected that cross contamination during sampling may have introduced the detected compounds into the well. No VOCs have been detected in MW77-97-11, except for single detections of trace to low concentrations (2.2 µg/L maximum) of 1,1-DCA in July 1997, chloroform in May 1999, and PCE in July 2003. Monitoring wells MW31-97-17, MW31-97-18, and MW31-98-17 were installed near Chicken Creek, downgradient from wells MWP-9, MWP-10, and MW77-97-11. MW31-98-17 is located near the site perimeter. No VOCs have been detected in these wells except for a trace concentration (<1 µg/L) of methyl tert-butyl ether (MTBE) in MW31-97-17 in August 2000.

- Observation well OW3-225, located in the Horseshoe Parking Lot southwest of Building 70A (Figure 7), was installed by UC in 1989. No VOCs have been detected in this well since February 1997. The anomalous detections of VOCs in 1994 and 1997 were attributed to sample cross-contamination.

- Well CD-92-28 (offsite) was installed in 1992 downgradient from the Building 37 solvent plume (Figure 7). The well was constructed on UC property on Centennial Drive near Strawberry Canyon Recreation Area. Except for low concentrations of PCE and/or TCE detected in November 1996, February 1997, and May 2004 VOCs have not been detected in CD-92-28. The presence of PCE and TCE was attributed to sample cross-contamination.

- Several other wells that have been identified as perimeter wells monitor the quality of groundwater downgradient from the developed areas of the site including: MW88-93-11A, MW62-92-26, and MW62-92-27 (Figure 7); MW74-94-7 and MW74-94-8 (Figure 8i); MW61-92-12 (Figure 8h); and MW25-95-27 (Figure 8a). No halogenated VOCs were detected in these wells during the current reporting period.

4.2.2 Petroleum Hydrocarbons and Aromatic VOCs

4.2.2.1 Former or Abandoned UST Sites

The presence of petroleum hydrocarbons and aromatic hydrocarbons in groundwater at LBNL is primarily the result of past releases from former or abandoned underground storage tank (UST) sites. Following is a summary of analytical results for the current reporting period from former or abandoned UST sites where groundwater is sampled for petroleum hydrocarbons.

The maximum concentrations of TPH detected at former or abandoned UST sites during the current reporting period were 580 µg/L TPH-diesel (TPH-D) and 150 µg/L TPH-kerosene (TPH-K) (Table 12). No aromatic or non-halogenated VOCs were detected.

Petroleum Hydrocarbons Detected at Monitored Former or Abandoned UST Sites

AOC Number	AOC Name	Monitoring Well	TPH Detected During Current Reporting Period (µg/L)	Aromatic or Non-Halogenated VOCs Detected During Current Reporting Period
AOC 2-1*	Former Building 7E Diesel/Kerosene UST	MW7-92-16	TPH-K=74	ND
		MW6-93-4	TPH-K=150	ND
		MW6-95-14	TPH-K=ND	ND
AOC 4-1**	Building 76 Former Gasoline UST	MW76-1	TPH-G=ND	ND
AOC 4-2**	Building 76 Former Diesel UST	MW76-1	TPH-D=ND	ND
		MW76-93-6	TPH-D=210	ND
AOC 6-1**	Building 88 Abandoned Diesel UST	MW88-93-13	TPH-D=ND	ND
AOC 11-1**	Building 74 Former Diesel UST	MW74-92-13	TPH-D=110	NA
		MW83-92-14	TPH-D=580	NA
		MW74-94-7	TPH-D=ND	ND
		MW74-94-8	TPH-D=62	ND
		MW74-95-6	TPH-D=320	ND
		MW83-95-7	TPH-D=230	NA
AOC 13-2**	Building 62 Former Diesel UST	MW62-B1A	TPH-D=ND	ND
		MW62-B2	TPH-D=ND	ND
		MW62-95-16	TPH-D=ND	ND

TPH-G: Total petroleum hydrocarbons in the gasoline range
TPH-K: Total petroleum hydrocarbons in the kerosene range
TPH-D: Total petroleum hydrocarbons in the diesel range
NA = Not analyzed during current reporting period.
ND = Not detected during current reporting period.
*Former or Abandoned UST Site not included in the Corrective Measure Study based on results of the Human Health Risk Assessment
**Former or Abandoned UST Site Approved for No Further Action (NFA) by the City of Berkeley.

Two groundwater contamination plumes are associated with former UST sites: the Building 7 Diesel Plume and the Building 74 Diesel plume.

Building 7 Diesel Plume (AOC 2-1)

Description

The Building 7 Diesel Plume contains diesel- and kerosene-range petroleum hydrocarbons (TPH-D and TPH-K). The plume is located immediately north of Building 6, and extends

westwards from the source of contamination, the former Building 7E Kerosene Underground Storage Tank (UST). The UST and adjacent contaminated soil were excavated in 1989.

ICMs, Pilot Tests, and Corrective Measures

Dual-phase (groundwater and soil vapor) extraction has been conducted in the source area since 1998, with extraction primarily from well MW6-95-14, located within the former UST excavation, and alternately from well MW6-93-4, located downgradient from the excavation. Groundwater is treated using GAC, then discharged to the sanitary sewer, or reinjected in the Old Town VOC plume core area for soil flushing. Groundwater quality at the former UST location is monitored by well MW7-92-16, which is also located within the UST excavation, but screened at a greater depth than MW6-95-14. Soil gas is treated by a second GAC system, and then released to the atmosphere under permit from the Bay Area Air Quality Management District (BAAQMD).

No corrective measures were required for the Building 7 Diesel Plume. Therefore, this unit is not included in the CMI phase of the CAP.

Contaminant Concentration Trends

The concentration trend for TPH-K in well MW7-92-16 is shown on Figure 31. The concentration of TPH-K detected has decreased from approximately 100,000 µg/L or more prior to the start of dual phase extraction in 1998 to approximately 1,000 µg/L or less. During the current reporting period, TPH-K was detected at concentrations of 74 µg/L and 150 µg/L in MW7-92-16 and MW6-93-4, respectively (Table 12). Aromatic hydrocarbons were not detected in any of the wells monitoring the plume during the current reporting period.

Building 74 Diesel Plume

Description

The Building 74 Diesel Plume contains diesel-range petroleum hydrocarbons. The source of the plume was apparently a pipeline leak associated with the former Building 74 Underground Diesel Storage Tank (AOC 11-1). The tank was installed in 1979 and removed in

November 1994. Except for 1,3,5-trimethylbenzene (1.8 µg/L) in July 2003, aromatic hydrocarbons have not been detected in any of the wells monitoring the plume since February 1995.

ICMs, Pilot Tests, and Corrective Measures

No corrective measures were required for the Building 74 Diesel Plume. Therefore, this unit is not included in the CMI phase of the CAP.

Contaminant Concentration Trends

Concentrations trends for TPH-D in the six wells monitoring the plume are shown on Figure 32. During the current reporting period TPH-D ranged from not detected (<50 µg/L) to 580µg/L. Long-term TPH-D concentrations in the six wells have been variable, with average concentrations in each of the wells of approximately 200 µg/L. Three of the six wells were also sampled for VOCs during the current reporting period. No VOCs were detected.

4.2.2.2 Aromatic and Non-Halogenated Hydrocarbons and Petroleum Hydrocarbons Not Associated with UST Sites

In addition to the former UST locations discussed in the previous section, samples were collected at the locations listed in the following table to evaluate the presence of petroleum hydrocarbons. TPH-D was not detected at the former Building 52B Abandoned Above Ground Storage Tank site or at the Building 37 Electrical Substation. The results are consistent with previous results from the wells.

Summary of Fourth Quarter FY05 Results for Units Other than UST Sites that have been Monitored for Petroleum Hydrocarbons

Unit Number	Unit Name	Monitoring Well	Fuel Analytes Detected During Current Reporting Period	Aromatic VOCs and MTBE Detected During Current Reporting Period
SWMU 2-2*	Building 52B Abandoned Above Ground Storage Tank	MW52B-95-13	ND	ND
AOC 14-7*	Building 37 Electrical Substation	MW37-94-9	ND	ND

ND = Not detected during current reporting period.
* Unit recommended not to be retained in the Corrective Measure Study based on results of the Human Health Risk Assessment.

TPH-crude/waste oil (TPH-C/WO), TPH-hydraulic/motor oil (TPH-H/MO), or TPH-D (250 µg/L maximum concentration) was detected in four wells not associated with known or potential fuel release sites. Three of the wells are located in the Support Services Area (MW76-93-6, MW69-97-8, and MW75-97-5). In addition, TPH-D was detected in one well monitoring the Old Town plume (MW58-93-3). The results are consistent with previous results from the wells. The sources of the TPH are not known.

Wells in which aromatic or non-halogenated hydrocarbons were detected during the current reporting period are listed in the following table. The only aromatic or non-halogenated hydrocarbons detected were benzene in five wells and toluene in three wells. The results are consistent with previous results from the wells. The concentrations of benzene detected in four of the wells (MW75A-00-7, MW91-4, MW7-00-4, and MW53-92-21-130') were above the MCL. The benzene detected in these four deep Orinda Formation wells may be naturally occurring.

Concentrations (µg/L) of Aromatic and Non-Halogenated Hydrocarbons Detected in Groundwater (Fourth Quarter FY05)

Detected Compounds	MCL (µg/L)	Well	Concentration (µg/L)
benzene	1	MW75A-00-7	70
		MW7-00-4	5.1
		MW91-4	18
		MW53-92-21-130'	1.3
		SB69A-99-1	0.8
toluene	150	SB69A-99-1	0.7
		SB64-99-5	1.8
		MW75A-00-7	1.8

4.2.3 Tritium

Description

The Building 75 Tritium Plume extends from the Corporation Yard (the area between Buildings 69 and 75) southwards towards Chicken Creek (Figures 33 and 34). The source of the plume was the former National Tritium Labeling Facility (NTLF), which operated inside Building 75 for almost 20 years until December 2001. Tritium has also been detected in a

localized area near Building 71B, with concentrations substantially less than those detected in the Building 75 area. The tritium in the groundwater in this area was likely derived from surface runoff from the Lawrence Hall of Science area to the northeast of Building 71. Concentrations of tritium detected in groundwater during FY05 are listed in Table 13 and shown at the monitoring well locations on Figure 33 and Figure 34, for the current reporting period.

ICMs, Pilot Tests, and Corrective Measures

Slope stability and observation wells within the Support Services Area were previously upgraded with bentonite and cement surface seals or were properly destroyed by overdrilling and backfilling with concrete to prevent infiltration of potentially contaminated surface water. Corrugated-metal stormdrains in this area were previously lined with PVC casings to prevent leakage of water from the stormdrains resulting in artificial recharge to the groundwater, and thereby reduce potential downgradient migration of tritium-contaminated groundwater. In addition, a defect identified in the sanitary sewer line southeast of Building 75B was repaired in 1997.

Tritium is not regulated under RCRA and is therefore not included in the RCRA CAP. Groundwater will continue to be monitored for tritium to ensure that current conditions are maintained or improved (i.e., tritium activities remain below levels of concern) by verification of the following:

1. Tritium activities remain below levels of concern (MCLs)
2. Tritium does not migrate offsite in the groundwater
3. The groundwater plume remains stable or the magnitude and/or extent of contamination decreases.

Contaminant Concentration Trends

Tritium concentration trends in wells monitoring the Building 75 Tritium Plume are shown on Figure 35a (core area), Figure 35b (source area), Figure 35c (western transgradient area), Figure 35d (eastern transgradient area), 35e (far western transgradient area), and 35f (downgradient area). As can be seen on the figures, concentrations of tritium have been declining since closure of the NTLF or show more recent declining trends in almost all wells monitoring the plume, with concentrations currently below the MCL in all wells. Significant

decreases in concentrations have been observed in wells monitoring the crossgradient areas of the plume (Building 76 and Building 69 areas), as shown by concentrations in MW69-97-21, MW76-1, and MW76-98-21, which have declined to levels below the Minimum Detectable Activity (MDA) of 300 pCi/L. These findings indicate a reduction in the lateral extent of the plume. MW75-99-6 in the source area (Figure 35b), MW91-2 in the western transgradient area (Figure 35c), and possibly MW31-97-17 in the downgradient area (Figure 35f) are exceptions to the decreasing trend.

Tritium concentration trends in wells monitoring the Building 71 area are shown on Figure 36. The concentration of tritium in the groundwater near Building 71 has generally been below (<300 pCi/L) or only slightly above (610 pCi/L maximum) the reporting limit since closure of the NTLF. MW71-95-9 and MW71B-98-13 (570 pCi/L maximum) were the only Building 71 area wells in which tritium was detected during the current reporting period (Figure 33).

4.2.4 Metals

Annual site-wide sampling of groundwater monitoring wells for metals was conducted during the current reporting period. Concentrations of metals detected are listed in Table 14. The following table lists the monitoring wells and associated metals that were detected at concentrations above LBNL background levels and MCLs (if the metal has an MCL) during the current reporting period.

Metals Detected at Concentrations Above MCLs and Background Levels During the Fourth Quarter of FY05

Inorganic Element of Potential Concern	Monitoring Well
arsenic	MW51B-93-18A
	MW7-00-4
	MW52A-00-6
	MW64-97-1
	MW37-92-18A
barium	MW69-97-8
selenium	MW64-97-2
molybdenum*	MW77-92-10
	MW77-94-5
	MW46-92-9
	MW51-92-2
	MW51-00-9
	MW51-00-10
	MW7-00-4
	MW58A-00-3
	MW52A-00-6

* molybdenum has no specified MCL

Detected metals concentrations were consistent with previous analytical results (LBNL, 2005c). MW7-00-4, MW58A-00-3, and MW52A-00-6 are deep wells screened in the Orinda Formation. The elevated levels of arsenic and/or molybdenum detected in these wells are likely naturally occurring.

4.2.5 PCBs

Samples were collected from 17 groundwater monitoring wells and temporary sampling points during the current reporting period and analyzed for PCBs (Table 15). The areas sampled included the Building 52 Former Hazardous Materials Storage Area (MW52B-95-13), the former Building 75 Hazardous Waste Handling Facility (Area 3 samples), the Building 51 Sanitary Sewer and Drainage System (Area 9 samples), and the Building 16 Former Waste Accumulation Area (SB16-97-11). PCBs were only detected in samples collected beneath the Building 51 Motor Generator Room Basement (Area 9 samples). PCBs were detected in four of the seven samples at

concentrations ranging from 0.76 to 30 µg/L. Detected PCB concentrations were consistent with previous analytical results

4.3 CORRECTIVE MEASURES AT SOIL UNITS

Sixty-eight soil samples were collected from 18 borings during the third and fourth quarters of FY2005 to delineate the extent of excavation that will be necessary to achieve the required Media Cleanup Standards (MCSs) for the Building 51L Groundwater Solvent Plume Source Area. Samples were analyzed for VOCs by EPA Method 8260. Sampling locations are shown on Figure 37. Concentrations of VOCS detected during the current reporting period are listed in Table 16.

4.4 WELL DESTRUCTION

On August 22, 2005, LBNL submitted permit applications for the destruction of 42 wells (including groundwater monitoring wells, temporary groundwater sampling points, and one soil-gas monitoring well) to the City of Berkeley. The monitoring wells were approved for destruction by the Regional Water Quality Control Board (Water Board) since they were no longer required for monitoring site groundwater (Water Board, 2005). From September 6, 2005 through September 28, 2005, 32 groundwater monitoring wells, six temporary groundwater sampling points, and one soil-gas monitoring well included in the permit application were destroyed in accordance with regulatory requirements. Thirty-four of the wells were destroyed by drilling out all the well construction materials and grouting the borings. The other five wells were either grouted in place or grouted as the casing was removed due to physical constraints preventing drilling out the well construction materials. The wells that were abandoned, the date each well was abandoned, and the abandonment method are listed in the following table.

Wells Destroyed During September 2005

Date Destroyed	Well Number	Well Destruction Method		
		Drilling Out Well Construction Materials and Grouting Boring	Grouting in Place	Grouting Boring Through Well Casing as Casing was Removed
September 6, 2005	MW88-96-4	●		
	SB64-03-3	●		
September 7, 2005	MW70A-96-13	●		
	MW51-00-1	●		
	SB51-96-20R	●		
	MW62-B2	●		
September 8, 2005	MW70A-96-14	●		
September 9, 2005	SB64-03-2	●		
	MW37-94-9	●		
September 12, 2005	MW70-92-7	●		
	MW51-96-19	●		
September 13, 2005	MW4-96-2	●		
September 14, 2005	MW25-93-15	●		
	MW51A-01-10A	●		
September 15, 2005	MW51-97-4	●		
	71-95-10	●		
	MW71-97-23	●		
September 16, 2005	MW71-95-8	●		
	MW51-94-11	●		
	MW71-94-1	●		
September 19, 2005	MW71-93-1	●		
	MW25A-95-4	●		
	MW77-93-8	●		
	MW69A-00-11	●		
September 20, 2005	MW52-94-10	●		
	MW62-95-16	●		
	MW62-B1A	●		
September 21, 2005	MW91-5	●		
	MW91-3	●		
September 23, 2005	MW25A-99-5	●		
	SB17-02-1	●		
September 26, 2005	MW1-220		●	
	MW75-92-23	●		
September 27, 2005	MW83-95-7	●		
	MW76-93-7	●		
September 28, 2005	MW88-92-4		●	
	SB6-96-2			●
	SB6-96-1			●
	MW46A-93-19		●	

4.5 REPORTS AND MEETINGS DURING THE CURRENT REPORTING PERIOD

Reports and Workplans

- On August 1, 2005, the Water Board approved LBNL's Proposal for Revised Groundwater Monitoring Schedule dated May 2005. The proposal included the destruction of 61 groundwater monitoring wells that were no longer needed.
- On August 22, 2005, LBNL submitted permit applications to the City of Berkeley for well destruction in (i) the Bevalac and Old town Areas and (ii) the Support Services and Outlying Areas.
- On August 31, 2005, LBNL submitted the Quarterly Progress Report for the Second Quarter of FY05 to the DTSC, in compliance with LBNL's RCRA Part B Permit.
- On September 26, 2005, LBNL submitted the Corrective Measures Implementation (CMI) Workplan for Soil Excavation, Building 51L Groundwater Solvent Plume Source Area to DTSC (LBNL, 2005e).

Meetings

- Remedial Project Managers meetings were held at the DTSC offices on August 11 and September 8, 2005. Representatives of the DTSC, Water Board, City of Berkeley, DOE, and LBNL attended both meetings, except for the August meeting at which a Water Board representative was not present and the September meeting at which a City of Berkeley representative was not present.

SECTION 5

SUMMARY OF PROBLEMS ENCOUNTERED

5.1 DEFINITIONS

In accordance with the LBNL RCRA Part B Hazardous Waste Facility Permit, Quarterly Progress Reports are required to address problems encountered and actions taken to rectify problems. Problems are defined here as follows:

1. Quality Assurance and Quality Control problems that would result in failure to meet data quality objectives.
2. Findings that indicate the presence of contamination that could impact human health or the environment, and for which activities are not specified in existing workplans to either further evaluate or remediate the contamination.

5.2 QUALITY ASSURANCE / QUALITY CONTROL

5.2.1 Laboratory Quality Control

Laboratory quality assurance/quality control (QA/QC) problems identified in the laboratory data packages are noted in the following table. The affected samples were noted (flagged) in the database. The data validation review indicated that the identified laboratory QA/QC problems were not sufficient to assign an "R" qualifier (i.e., the data are not usable for any project purpose) to any of the data.

Analytical Laboratory Deficiencies

Laboratory	Chain of Custody	Location	Deficiency
BC Laboratories	8-05-119	MW51L-01A	Zinc, mercury, and chromium were detected in the method blank at a level between the PQL and MDL.
	8-05-120	MW51L-02-1	Zinc, mercury, and chromium were detected in the method blank at a level between the PQL and MDL.

5.2.2 Field Quality Control

QC Samples

Nine field (equipment/rinse) blanks and six trip blanks were collected and analyzed for VOCs during the current reporting period (Table 17). In addition, two equipment/rinse blanks were analyzed for TPH-D (Table 12), four for tritium (Table 13), and two for metals (Table 14). No analytes were detected n any of the blanks.

Four duplicate groundwater samples were collected and analyzed for VOCs, three for tritium, and three for metals during the current reporting period. Duplicate results were consistent with the primary sample results. The relative percent difference (RPD) for the duplicate VOC samples ranged from 4% to 28%, with the results provided by BC laboratories generally greater than those of the LBNL EML, consistent with differences observed in the past. The RPD for tritium results ranged from approximately 1% to 3% and for metals from 0% to 17%.

SECTION 6

GROUNDWATER TREATMENT SYSTEMS

6.1 DESCRIPTION OF SYSTEMS

Extracted groundwater and contaminated effluent from drain lines and hydraugers is treated to non-detectable levels of VOCs at granular activated carbon (GAC) treatment systems. The treated water is injected into the subsurface for soil flushing purposes or discharged to the sanitary sewer in accordance with the provisions of LBNL's Wastewater Discharge permit issued by EBMUD.

Schematic diagrams and sampling requirements for these systems are contained in LBNL Standard Operating Procedure (SOP) 4.6 Water Treatment Systems (LBNL, 1994c). Following is a summary of treatment system installations.

- In 1991, the *Building 51 Hydraugers Treatment System* was installed to treat effluent from hydraugers with detectable concentrations of VOCs. This treatment system was deactivated in February 2000 and the hydrauger effluent rerouted to the Building 51 Fire Trail Treatment System.

- The *Building 51 Fire Trail Treatment System* was installed in 1992 on the fire trail east of Building 51 to treat groundwater from monitoring well MW90-5, which is extracted to control migration of the Building 71 VOC plume. Beginning in March 1996, groundwater extracted from MW58-95-18 near the downgradient edge of the southern lobe of the Old Town plume was also treated by the system. A groundwater collection trench was installed downgradient from MW58-95-18 during the first quarter of FY99 to more effectively control plume migration. The treatment system currently consists of two 1000-pound GAC canisters in series and treats contaminated groundwater pumped from collection trench extraction wells EW58-98-1 and EW58-98-2. In addition, effluent from hydraugers east of Building 51 with detectable concentrations of VOCs (hydraugers 51-01-01, 51-01-02, 51-01-03, 51-01-03A, 51-01-04, and 51-01-09) has been treated at this system since February 2000.

- In 1993, the *Building 37 Treatment System* was installed to treat VOC contaminated water from a drain (37-01-01) east of Building 37 and two wells near the site perimeter monitoring the Building 37 VOC Plume (MWP-7 and MW37-92-6). Extraction from MWP-7 and MW37-92-6 was halted on June 4, 2001 after concentrations of VOCs in both wells had remained been below MCLs for more than one year.

- In April 1993, the *Building 46 Treatment System* was installed to treat the water collected from the subdrain east of Building 46. The subdrain was installed in the early 1950's to collect water draining from the hillside for landslide mitigation purposes. Before 1993, the collected water was discharged to a catch basin, and then routed to the storm drain system that discharged to North Fork Strawberry Creek. In February 1993, VOCs were detected in water samples collected from the catch basin and the treatment system was therefore installed. The system previously consisted of two parallel sets of two 55-gallon GAC units in series. In August 2003, one of the sets was replaced by a series of two 1000-pound GAC canisters.

- In July 1996, the *Building 51 Motor Generator Room Discharge Sump Treatment System* was installed to treat the VOC-contaminated effluent from the Motor Generator Room discharge sump located in the basement of the Motor Generator Room in Building 51. The system consists of two 1000-pound GAC canisters in series. The Building 51 system also treats groundwater from extraction well EW64-00-1, which was installed in the backfill of the source removal excavation for the Building 51/64 groundwater plume.

- In December 1996, the *Building 7 Collection Trench Groundwater Treatment System* was installed at the former location of Building 7B to treat VOC-contaminated water extracted from the Building 7 groundwater collection trench, as part of a soil flushing system. The system previously consisted of two 1000-pound GAC canisters in series, but was upgraded with a third 1000-pound canister in September 2003. The system also treats groundwater extracted from the Building 53/58 slope collection trench system, the collection trench at the southeast corner of Building 58, and other extraction wells in the Old Town Solvent Plume core area.

- In September 1998, the *Building 6 Treatment System* was installed on the east side of Building 6 as part of a dual phase groundwater and soil gas extraction and treatment system. The system consists of two 1000-pound GAC canisters in series. Groundwater extraction was started on September 18, 1998. Soil vapor extraction was started on October 20, 1998. The treated water has recently been used for soil flushing purposes.

- In February 2000, the *Building 51L Treatment System* was installed southwest of Building 51L to treat contaminated groundwater extracted from EW51L-99-1 and EW51L-00-1. The system consists of one 1000-pound GAC canister and one 55-gallon GAC unit in series. Since the third quarter of FY02, the system has also treated contaminated water extracted from a concrete sump inside Building 51A. Since January 2004, the system has also treated contaminated groundwater extracted from SB51A-01-8B, as part of a soil flushing system.

- In April 2002, the *Building 25A Treatment System* was installed west of Building 25A to treat contaminated groundwater extracted from the Building 25A collection trench, as part of a soil flushing system. The treatment system consists of one 1000-pound GAC canister and one 55-gallon GAC unit in series. Groundwater extracted from MW 25A-98-3 is also treated by the system.

- In October 2003, the *Building 64 Treatment System* was completed east of Building 64 to treat contaminated groundwater extracted from the Building 64 groundwater collection trenches, as part of a soil flushing system. The treatment system consists of a 1,000-pound GAC canister with an in-line 55-gallon GAC drum as backup. The system also treats groundwater extracted from extraction wells EW64-03-1, EW64-05-1, SB64-05-4 and from other temporary groundwater sampling points inside Building 64.

- In September 2004, the *Building 71B Treatment System* was completed south of Building 71B to treat contaminated groundwater extracted from SB71B-04-1, as part of a soil flushing system. The treatment system consists of two 1,000-pound GAC canisters in series.

- In September 2005, the *Building 53 Treatment System* was completed on the north side of Building 53 to treat contaminated groundwater extracted as part of the Building 52 lobe soil flushing system. The treatment system consists of a 1,000-pound GAC canister with an in-line 55-gallon GAC drum as backup.

6.2 VOLUME OF GROUNDWATER TREATED

The following volumes of contaminated water have been treated by these systems:

Summary of Treatment Systems

Treatment System	Volume Treated Fourth Quarter FY05 (gallons)	Total Volume Treated (gallons)	Discharge/Reuse
Building 6 Bioventing	245,115	2,646,305	Sanitary sewer or recirculated
Building 7 Trench	557,735	8,600,142	Recirculated or sanitary sewer
Building 37	3,557	1,681,016	Makeup water for cooling tower
Building 46	472,670	15,673,172	Recirculated or sanitary sewer
Building 51 Firetrail	259,454	7,869,343	Sanitary sewer
Building 51 Hydraugers*	0	9,482,665	*
Building 51 Sump	29,269	3,294,417	Sanitary sewer
Building 51L	29,142	887,155	Sanitary sewer
Building 25A	113,470	809,565	Recirculated
Building 64	29,120	383,756	Recirculated
Building 71B	19,849	181,436	Recirculated
Building 53	369,860	1,856,141	Recirculated
Total Volume Treated	2,129,241	53,365,113	

*System no longer operational. Hydrauger effluent is now treated at Building 51 Firetrail Treatment System.

SECTION 7

UPCOMING ACTIVITIES

7.1 ACTIVITIES COMPLETED DURING THE UPCOMING REPORTING PERIOD (FIRST QUARTER FISCAL YEAR 2006)

This section describes the activities that were completed during the first quarter of FY06 (October 1 to December 31, 2005), the upcoming reporting period. These activities will be included in the next Quarterly Progress Report, scheduled for submittal to DTSC in May 2006.

Groundwater Investigations

Quarterly Sampling

First quarter FY06 groundwater sampling started on October 3, 2005 and was completed on December 20, 2005. The number of groundwater samples submitted for each type of analysis during the first quarter of FY06 is shown in the following table:

Number of Groundwater Samples Collected During the First Quarter of FY 2006

	VOCs	TPH			PCBs	Metals	Tritium	Total
		-D	-G	-FF				
Monitoring Wells Primary Samples	69					2	1	72
Duplicate Samples	4							4
Trip Blanks	3							3
Rinse Blanks	5						1	6
Slope Stability Wells	5							5
Temporary Sampling Points	122	3	3	2	5	2	1	138
Extraction Wells	76							76

VOCs: Volatile Organic Compounds
TPH-D: Total Petroleum Hydrocarbons in the diesel range
TPH-G: Total Petroleum Hydrocarbons in the gasoline range
TPH-FF: Total Petroleum Hydrocarbons-fuel fingerprint
PCBs: Polychlorinated Biphenyls

Other Activities

Well Destruction

On August 22, 2005, LBNL submitted permit applications for the destruction of 42 wells (including groundwater monitoring wells, temporary groundwater sampling points, and one soil-gas monitoring well) to the City of Berkeley. The monitoring wells were approved for destruction by the Water Board since they were no longer required for monitoring site groundwater. The final well in the permit application, MW37-92-5 was destroyed on December 9, 2005. The other wells were destroyed during the previous reporting period.

Reports

- On October 20, 2005, the DTSC informed LBNL that the CMS Report was approved and effective immediately
- LBNL submitted the Corrective Measures Implementation (CMI) Workplan for Soil Excavation, Building 7 Sump of the Old Town Groundwater Solvent Plume Source Area to the DTSC on November 2, 2005.
- LBNL submitted the Corrective Measures Implementation (CMI) Workplan to the DTSC on November 10, 2005.
- LBNL submitted the Quarterly Progress Report for the Third Quarter of FY04 to the DTSC on November 30, 2005, in compliance with LBNL's RCRA Part B Permit.

Meetings

The following meetings were held with the regulatory agencies:

- A Remedial Project Managers meeting was held at the DTSC offices on November 10, 2005. Representatives of the DTSC, Water Board, and City of Berkeley attended.
- The semi-annual review meeting was held on October 26, 2005

7.2 ONGOING ACTIVITIES

This section describes ongoing activities that continued through the first quarter of FY06 (October 1 to December 31, 2005), the upcoming reporting period. New or significant results of these activities will be reported in the next Quarterly Progress Report, scheduled for submittal to DTSC in May 2006. Following is a summary of the ICMs and pilot tests that were implemented

during previous reporting periods and are continuing as the approved corrective measures for contaminated groundwater.

Old Town Groundwater Solvent Plume (Building 7 lobe)

- Continued operation of the in situ soil flushing system (Building 7 Groundwater Collection Trench) in the Building 7 lobe source area downgradient from the former Building 7 sump location.

- Continued operation of the in situ soil flushing system in the building 7 lobe core area downgradient from the Building 7 Groundwater Collection Trench.

- Continued operation of the following groundwater collection trenches to control plume migration.
  - Building 58 West Groundwater Collection Trench
  - Building 58 Southeast Groundwater Collection Trench.

- Continued operation of the dual-phase (groundwater and soil vapor) extraction wells on the Building 53/58 slope.

Old Town Groundwater Solvent Plume (Building 52 Lobe)

- Continued in situ soil flushing in the Building 52 lobe source area.
- Continued extraction and treatment of groundwater water from the Building 46 subdrain.

Old Town Groundwater Solvent Plume (Building 25A Lobe)

- Continued in situ soil flushing in the Building 25A lobe source area.

Building 51/64 Groundwater Solvent Plume

- Continued in situ soil flushing in the source area.

Building 71B Lobe of the Building 71 Groundwater Solvent Plume Area

- Continued in situ soil flushing/HRC injection in the source area.

Building 51L Groundwater Solvent Plume

- Continued operation of the groundwater extraction and treatment system until the storm drain is reconstructed to prevent the inflow of contaminated groundwater into the storm drain system.

Contaminated Drain Lines

- Continued capture and treatment of contaminated Building 51 area hydrauger effluent.
- Continued extraction and treatment of contaminated water from the Building 51 drainage system.
- Continued to extract and treat water from an electrical utility manhole (EMH-133) and drain 37-01-01 east of Building 6.

In addition to the corrective measures noted above, the following activities continued during the reporting period:

Building 7 Diesel Plume - Building 7E Former Underground Storage Tank (UST) (AOC 2-1)

- Continued operation of the Building 6 dual-phase (groundwater and soil vapor) extraction system.

Contaminated Drain Lines

- Continued extraction and treatment of water from the concrete sump installed inside Building 51A and SB58-98-4.

7.3 PLANNED ACTIVITIES

In addition to the ongoing activities described in Section 7.2, following is a list of activities planned for the second and third quarters of FY06 (January 1 to June 30, 2006):

- Submit the Quarterly Progress Reports for the fourth quarter of FY05 and first quarter of FY06 to the DTSC.
- Continue planning and design work for CMI (excavation) in the source area of the Building 51L Groundwater Solvent Plume and the Former Building 7 Sump area. Begin implementation of the corrective measures.
- Continue to hold Remedial Project Manager (RPM) meetings with the regulatory agencies.
- Conduct quarterly groundwater sampling and continue depth-to-water measurements.
- Submit a Groundwater Monitoring and Management Plan and a Soil Management Plan to DTSC.

SECTION 8

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